SECTION 21 2200

CLEAN AGENT FIRE-EXTINGUISHING SYSTEMS

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LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Fire POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within “stars” during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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As a minimum, include the following specifications to bid package.

01 4219	Reference Standards
01 3300	Submittal Procedures
01 3545	Water Discharge Requirements
01 2500	Substitution Procedures
01 7700	Closeout Procedures
01 7839	Project Record Documents
Div. 21	Applicable fire alarm system specifications
22 0554	Identification for Plumbing, HVAC, and Fire Piping and Equipment
22 0816	Disinfection of Potable Water Piping
22 0813	Testing Piping Systems

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Scope of Work: Provide design, shop drawings, project record drawings (as-built), equipment, fabrication, labor, transportation and supervision necessary to install, test and place into service a clean agent extinguishing system.

B. Components: System shall consist of, but not be limited to piping and nozzles, fittings, extinguishing agent, extinguishing agent containers, system control panel, wiring, detection and alarm devices, and other devices for a complete installation in accordance with codes, standards and recommended practice referenced in this Section.

1.2 DESIGN

A. Design system in accordance with NFPA 2001.

1. Design a complete engineered, total flooding system using HFC-227ea (FE-227/FM-200).

2. Design system for Class A, B, or C fires as appropriate for the areas being protected and include safety factor. Use agent concentration suitable for normally-occupied areas.

3. Design to discharge extinguishing agent within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time.

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Select the type of detection to actuate the clean agent system:

4. Detection to consist of photoelectric detectors arranged to operate the control panel in accordance with NFPA 2001 and NFPA 72. Detectors to be cross-zoned.

OR

4. Detection to consist of air-sampling detectors arranged to operate the control panel in accordance with NFPA 2001 and NFPA 72.

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5. Design to include manual activation by pull stations.

6. Extinguishing agent discharge to operate audible alarms and strobe lights.

7. Calculate the amount of agent required based on an elevation of 7000 ft [NOTE: this is conservative since higher LANL elevations require less agent].

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Add specific seismic design criteria for ML-1 and ML-2 systems.

B. Seismic Design: Provide seismic protection for ML-1 and ML-2 clean agent systems. Follow the LANL Engineering Standards Manual, Structural Chapter.

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1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 3300, Submittal Procedures:

B. Product data as specified in NFPA 2001, Section 3-1.2.

1. Extinguishing-agent containers.

2. Extinguishing agent.

3. Discharge nozzles.

4. Control panels.

5. Detection devices.

6. Manual-release stations.

7. Switches.

8. Alarm devices.

C. Shop Drawings using a minimum scale of 1/8" = 1'0" for plans and 1/4" = 1'0" for details. All lettering shall be a minimum of 1/8 inch high. Include information as specified in NFPA 2001, Section 3-1.2.

1. Layout drawings detailing the location of all agent storage tanks, pipe runs including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, and all mechanical, structural, and electrical interferences.

2. Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdowns.

3. Separate layouts or drawings for mechanical and electrical work.

4. Separate layout or drawings showing isometric details of agent storage containers, mounting details, and proposed pipe runs and sizes.

5. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs.

6. Provide complete hydraulic flow calculations from a UL-listed computer program. Calculation sheets must include the manufacturer's name and U.L. listing for verification. The individual sections of pipe and each fitting to be used, as shown on isometric drawings, must be identified and included in the calculations. Total agent discharge time must be shown and detailed by zone.

7. Submit drawings, calculations, and system component data sheets for approval before starting construction.

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If seismic protection applies, include this section:

D. Seismic Calculations: Submit the seismic calculations required by Section 1.2 B.

1. Provide calculations based on a dynamic analysis certified by a registered professional engineer with expertise in dynamic seismic analysis. Calculate in-structure response for the system such that performance of system within structure meets the required performance category criteria in DOE-STD-1020 as well as NFPA 13.

2. Provide qualifications of dynamic analyst and documentation of computer software systems for review and approval by LANL.

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E. Catalog Data with selected options noted.

F. Materials Part List (Bill of Materials) with manufacturer, model number, and quantity.

G. Test Reports

H. Operation and Maintenance Manual: Submit system description, system final inspection and Contractor's material and test certificates per NFPA 2001, of the completed system project record documents.

1. Include in operation and maintenance manuals, instructions, a brief description of type of system installed, routine maintenance work defined by step-by-step instructions, and recommended frequency of performance.

2. Also include in instructions, possible malfunctions with diagnostic methods and suggested correction of each.

3. Describe function of each component or subassembly.

I. Project Record Drawings (As-Built): Provide updated shop drawings on CDs and prints reflecting as-built conditions showing Work completed under this Section.

1. Base as-built drawings on actual survey of the completed installation.

2. Include notes on all special systems or devices such as damper and door closure interlocks.

3. List recommended spare parts (manufacturer, model number, and quantity).

1.4 QUALITY ASSURANCE

A. Provide proof that installation firm has satisfactorily performed at least ten projects of equivalent nature and scope of the Projects herein; and is licensed within the USA to engage in design, fabrication and installation of clean agent systems for fire protection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials and Equipment: Protect materials and equipment from damage during shipping, storage and installation.

B. Plugs and Cover Plates: Protect threaded ends, flanged openings with gasketed metal cover plates to prevent damage during shipment and to prevent foreign materials from entering. Cap or plug drains, vents, small piping, and gauge connections.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

A. Chemetron Fire Systems

B. Fike Corp.; Fire Protection Systems Div.

C. Kidde-Fenwal, Inc.

2.2 DESIGN

A. Provide new fire protection materials and equipment, UL Listed or FM Approved, conforming to requirements of NFPA 2001.

2.3 PIPING AND FITTING MATERIALS

A. Provide in accordance with NFPA 2001.

2.4 VALVES

A. General: Brass; suitable for intended operation.

B. Container Valves: With rupture disc or solenoid, capable of immediate and total agent discharge and suitable for intended flow capacity.

C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure-relief device.

D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

2.5 DISCHARGE NOZZLES

A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

B. Nozzles shall be available in NPT pipe sizes ¼" through 2". Each size shall be available in 180 deg and 360 deg distribution patterns.

2.6 AGENT STORAGE CONTAINERS

A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.

1. Finish: Manufacturer's standard color, enamel or epoxy paint.

2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.

3. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

B. Each container shall have a pressure gauge and low-pressure switch to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual “Trouble” alarm in the event the container pressure drops below 272 psig. The pressure gauge shall be color coded to provide an easy visual indication of container pressure.

C. Each container shall have a pressure relief valve that automatically operates when the internal temperature exceeds 150 deg F.

D. Containers shall be actuated by parallel-wired initiators located at each agent container.

2.7 CONTROL PANELS

A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.

B. Power Requirements: 120-VAC; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.

C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.

1. Mounting: Surface

2. Locks for all panels shall be keyed alike.

D. Supervised Circuits: Separate circuits for each independent hazard area.

1. Provide the following for crossed-zoned-detection applications:

a. Zone 1 detection circuit.

b. Zone 2 detection circuit.

c. Manual pull-station circuit.

d. Alarm circuit.

e. Release circuit.

2. Provide the following control-panel features:

a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.

b. Automatic switchover to standby power at loss of primary power.

3. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

2.8 DETECTORS

A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:

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SELECT TYPES TO BE USED
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1. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.

2. If included in the contract, a Kidde-Fenwal AnaLASER air-sampling control panel may be used to activate the fire suppression system control panel.

2.9 MANUAL PULL STATIONS

A. Description: FM approved or UL listed, with “PULL STATION” caption, 24-V dc compatible with controls, and red finish. Include contacts for connection to control panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.

1. Mounting: Surface mounted.

2.10 ALARM DEVICES

A. Description: FM approved or UL listed, low voltage, and surface mounting, unless otherwise indicated.

B. Horns: 90 to 94 dBA.

C. Strobe Lights: Translucent lens, with “FIRE” or similar caption.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation carefully inspect installed Work of other trades, whether pre-existing or part of this Project, and verify that such work is complete to the point where installation of clean agent system may start.

B. Notify the Project Manager should conditions exist, not resulting from Work of this Project, that prohibits the installation from conforming to referenced codes, regulations, standards and approved design.

C. Install materials and equipment that are free of moisture, scale, corrosion, dirt and other foreign materials.

3.2 INSTALLATION

A. Install clean-agent extinguishing piping and other components level and plumb and according to manufacturers' written instructions.

B. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.

C. Anchor extinguishing-agent containers to substrate.

D. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section “Distribution,” and related Appendix A paragraphs; and ASME B31.1.

E. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.

F. Support piping using supports and methods according to NFPA 13.

G. Install seismic restraints for extinguishing-agent containers and piping systems.

H. All piping shall be reamed, blown clear, and swabbed with suitable solvents to remove burrs, mill varnish, and cutting oils before assembly.

I. Seal male threads with Teflon tape pipe sealant applied before assembly.

J. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section “Detection, Actuation, Alarm, and Control Systems,” as required for supervised system application.

K. Secure all ceiling tiles near discharge nozzles.

3.3 SIGNS:

A. Caution/Advisory Signs: Provide labeling on entrances, piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001, including:

1. Entrance sign at each entrance to a protected space.

2. Manual Discharge sign at each manual discharge station.

3. Flashing Light sign required at each flashing light over each exit from a protected space.

3.4 WIRING

A. Install wiring in electrical metallic tubing (EMT) or conduit.

B. Securely support all system components independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, installed parallel and perpendicular to walls and partitions.

C. Use conductor sizes specified by the system manufacturer. Color codes shall be used. All wires shall be free from grounds and crosses between conductors.

D. Install wiring to conform to the National Electric Code for Class 1 Signal Systems, except as otherwise permitted for limited energy circuits, as described in NFPA 72.

E. Ground the complete system electrical installation and all auxiliary components in accordance with the NEC (NFPA 70).

3.5 TESTING

A. After system installation is completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer’s recommended procedures and NFPA 2001, Section “Approval of Installations.”

B. Test containers and distribution piping for proper mounting and installation.

C. Test electrical wiring for proper connection, continuity, and resistance to ground.

D. Functionally test the complete system in the presence of the LANL Construction Inspector.

E. All functions, including system and equipment interlocks, must be operational at least five days prior to the final acceptance tests.

F. Notify LANL Construction Inspector at least 5 working days in advance to witness tests.

3.6 TRAINING

A. Prior to acceptance, provide operational training on the system to personnel designated by LANL.

B. Training session shall include system control panel operation, manual and abort functions, trouble procedures, auxiliary functions, and emergency procedures.

3.7 OPERATION AND MAINTENANCE

A. Prior to final acceptance, provide four (4) copies of a complete operation and maintenance manual. The manual shall include the following:

1. All aspects of system operation and maintenance detailed, including piping isometrics, wiring diagrams of all circuits, a written description of system design and sequence of operation

2. Drawing(s) illustrating control logic

3. Equipment used in the fire suppression system

4. Checklists and procedures for emergency situations

5. Troubleshooting techniques

6. Maintenance operations and procedures

3.8 AS-BUILT DRAWINGS

A. Provide four copies of system “as-built” drawings. Drawings shall include:

1. Actual equipment locations (control panels, agent containers, detectors, alarms, manual and abort switches)

2. Piping and conduit routing details

3. All room or facilities modifications

3.9 ACCEPTANCE TESTING

A. Conduct acceptance tests in the presence of the LANL Inspector.

B. The acceptance test shall include the following:

1. The entire control system to determine it functions as designed and intended. All circuits shall be tested, including:

   a. Automatic actuation

   b. Manual actuation

   c. HVAC and power shutdowns

   d. Audible and visual alarm devices

   e. Manual override of abort functions

   f. Smoke/fire damper operation

   g. Agent container pressure supervision

2. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.

3. Conduct a room pressurization test for each protected space to determine the presence of openings that would impact concentration levels during an activation. Conduct in accordance with NFPA 2001 requirements.

   a. If openings are discovered, coordinate the proper sealing of the protected space(s).

   b. Upon completion of repairs, conduct additional room pressurization tests, at no additional cost, until a successful test is obtained.

   c. Copies of successful test results shall be submitted to the LANL Construction Inspector.

END OF SECTION

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Do not delete the following reference information:
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FOR LANL USE ONLY

This project specification is based on LANL Master Specification 21 2200 Rev. 0, dated January 6, 2006.